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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/608,354	06/29/2000	Donald Hooper	10559/222001/P8715	8914

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EXAMINER

EDELMAN, BRADLEY E

ART UNIT	PAPER NUMBER
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2153

DATE MAILED: 10/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary**Application No.**

09/608,354

Applicant(s)

HOOPER, DONALD

Examiner

Bradley Edelman

Art Unit

2153

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 July 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 23-35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 23-35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 July 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

This office action is in response to Applicant's amendment and request for reconsideration filed on July 26, 2004. Claims 23-35 are presented for further examination.

Drawings

1. Examiner appreciates Applicant's corrections to the drawings, and has withdrawn the objections to the drawings.

Specification

Content of Specification

- (f) Brief Summary of the Invention: See MPEP § 608.01(d). A brief summary or general statement of the invention as set forth in 37 CFR 1.73. The summary is separate and distinct from the abstract and is directed toward the invention rather than the disclosure as a whole. The summary may point out the advantages of the invention or how it solves problems previously existent in the prior art (and preferably indicated in the Background of the Invention). In chemical cases it should point out in general terms the utility of the invention. If possible, the nature and gist of the invention or the inventive concept should be set forth. Objects of the invention should be treated briefly and only to the extent that they contribute to an understanding of the invention.
2. The disclosure is objected to because it lacks a brief summary of the invention, and thus fails to comply with 37 CFR 1.73. Examiner realizes that §1.73 does not require a brief summary, but notes that §1.73 strongly recommends it (i.e. "a brief summary of the invention... *should* precede the detailed description). Because §1.73 strongly recommends a brief summary, and because a brief summary would aid the

Art Unit: 2153

general public as well as the Patent Office in understanding the nature and gist of the invention, Examiner objects to its omission.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 23-32 are rejected under 35 U.S.C. 102(e) as being anticipated by Lipman et al. (U.S. patent No. 6,192,051, hereinafter "Lipman").

In considering claim 23, Lipman discloses a memory for storing data for access by a longest prefix match program being executed on a data processing system (Fig. 2, "forwarding controller memory" on the "controller"), comprising:

A data structure stored in the memory, the data structure including information resident in a database ("routing database"; col. 7, lines 21-23) used by the longest prefix match program and including:

A large table at a root ("Level 1 routing entries"; col. 10, line 34), the root branching to nodes containing small trie tables ("level-2 routing entries"; col. 10, lines 61-62; Fig. 7), each trie table addressed by a span of IP address bits ("IP address bits [15:8]") to locate an indexed trie entry (col. 10, lines 39-46, 61-63), the indexed trie entry

Art Unit: 2153

including a route pointer ("next hop address") and a trie pointer ("key"; col. 10, lines 39-46; col. 11, lines 5-14, wherein the next hop address points to a destination address and the key points to another trie table within the routing structure).

In considering claim 24, Lipman further discloses that the small trie tables each comprise prefix match fields for each indexed entry (i.e. "pointer values"; col. 11, lines 46-47), a population count of pointers (i.e. 256 level-2 entries, see Fig. 7), and hidden prefix entries (col. 12, lines 40-50, describing pointers that only act as prefix entries when another pointer is deleted).

In considering claim 25, Lipman further discloses that the hidden prefix entries hold shorter prefix entry pointers (col. 12, lines 51-58, describing the shorter entry pointers being used when the longer pointer is deleted).

In considering claim 26, Lipman further discloses that the small trie tables are stored in SRAM (i.e. cache) and used for route lookups ("lookup"; col. 9, lines 49-51), route adds ("adds"), and route deletes ("deletes"; col. 12, lines 1-14, 40-50).

In considering claim 27, Lipman further discloses that the indexed trie entry is a 32-bit longword (col. 10, lines 54-56; Fig. 7, box 140, showing the 32-bit IP address).

In considering claim 28, Lipman discloses a method of searching a database for a prefix representing a destination address (col. 7, lines 21-41, "routing database... enable[s] the device 10 to make decisions regarding how packets received on a segment 20 or 22 are to be forwarded), comprising:

Reading a data structure stored in a memory, the data structure comprising a large table at a root ("level-1 routing entries"; col. 10, lines 55-57), the root branching to two nodes containing small trie tables ("level-2 routing entries"; col. 10, lines 61-62; Fig. 7), each trie table addressed by a span of IP address bits ("IP address bits [15:8]") to locate an indexed trie entry (col. 10, lines 39-46, 61-63), the indexed trie entry including a route pointer ("next hop address") and a trie pointer ("key"; col. 10, lines 39-46; col. 11, lines 5-14, wherein the next hop address points to a destination address and the key points to another trie table within the routing structure); and

Traversing in parallel the two trie tables to find a match of a trie entry to the prefix (col. 14, lines 29-32, "there can be multiple lookups pending at a given time in the address resolution logic"; col. 16, lines 26-28, "comparison logic 192, and search control logic 194 of Fig. 9 are configured to compare the search key to four tree entries simultaneously").

In considering claim 29, Lipman further discloses that the route pointer represents the destination address ("next hop address") and the trie pointer points to a next small trie table ("key"; col. 10, lines 39-46; col. 11, lines 5-14, wherein the next hop

Art Unit: 2153

address points to a destination address and the key points to another trie table within the routing structure).

In considering claim 30, Lipman further discloses that the small trie tables each comprise prefix match fields for each indexed entry (i.e. "pointer values"; col. 11, lines 46-47), a population count of pointers (i.e. 256 level-2 entries, see Fig. 7), and hidden prefix entries (col. 12, lines 40-50, describing pointers that only act as prefix entries when another pointer is deleted).

In considering claim 31, Lipman further discloses reporting a non-match if the prefix does not match an entry (col. 12, lines 1-14, "if no such tree or trees exist, then new level-3 and/or level-2 trees are created for the new routing entry").

In considering claim 32, Lipman further discloses that a first large table is a single 64K entry table that is indexed by bits 31:16 of an IP address ("64k level 1 entries," "indexed by IP address bits [31:16]"; col. 10, lines 56-58).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 33-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lipman.

In considering claim 33, Lipman does not explicitly disclose that a second large table is indexed specifically by bits 31:24 of an IP address. However, Lipman does disclose that a second large table could be indexed by bits [31:20] and further suggests that "in alternative embodiments it may be desirable to shuffle the address fields with respect to the levels" (col. 18, line 65 – col. 19, line 5). Thus, as evidenced by Lipman, the specific selection of bits for indexing each level is a matter of design choice, and it would have been obvious to include only bits 31:24 in the root table taught by Lipman (rather than bits 31:16 or 31:20) because fewer indexing bits at any particular level allows traversal through that level to either be faster or to use less memory.

In considering claims 34 and 35, Lipman further discloses that the small tables are dynamically allocated (i.e. added to or deleted from in real time, col. 12, lines 1-50) and comprise:

A tree with each node representing 16 bits of addresses covering an extension of 1-16 bits of a prefix entry from a previous tree (Fig. 7, node 40, for example). Again, although Lipman does not explicitly disclose that the nodes in the small tables represent 4 bits of address covering an extension of 1-4 bits of a prefix entry from a previous tree, Lipman discloses that it may be desirable to shuffle the address fields with respect to the levels. Here, it would have been desirable to shuffle the address fields in level one such that each node at the level-2 table covers only 4 bits of addresses, in order to

simplify the level-2 and level-3 (or to even eliminate the need for the level-3) tables.

Therefore, it would have been obvious for the small tables taught by Lipman to have nodes representing only 4 bits of addresses, instead of 16 bits.

Response to Arguments

5. In response to Applicant's request for reconsideration filed on July 26, 2004, the following factual arguments are noted:

- a. The "routing table that contains a plurality of routing entries" taught by Lipman is not the same as the "large table at a root" claimed in claims 23 and 28.
- b. The "sub-trees at the three different levels that index into the routing entries" taught by Lipman are not the same as the "root branching to nodes containing small trie tables" claimed in claims 23 and 28.
- c. Lipman does not disclose "traversing in parallel the two trie tables to find a match of a trie entry to the prefix," as claimed in claim 28.

In considering (a), Applicant contends that the "routing table that contains a plurality of routing entries" taught by Lipman is not the same as the "large table at a root" claimed in claims 23 and 28. Examiner respectfully disagrees. Notably, Lipman states "the routing table contains a plurality of routing entries, segregated into groups as follows: level-1 routing entries 138...", col. 10, lines 33-35. Figure 7 shows this level-1 routing table as a large table at a root. Note that if the overall structure shown by Figure 7 is a routing table, then the portion of entries at level-1, described as a segregated

group of same-level entries, constitutes a sub-routing table in itself. Thus, Lipman discloses that the group of entries at level-1 constitute a routing table at a root.

In considering (b), Applicant contends that the "sub-trees at the three different levels that index into the routing entries" taught by Lipman are not the same as the "root branching to nodes containing small trie tables" claimed in claims 23 and 28. Examiner respectfully disagrees, for the reasons stated in the claim rejection above. Notably, Lipman explicitly discloses that the root branches to nodes containing smaller tables (Fig. 7, wherein as in point (a) above, the tables are essentially sub-routing tables of the overall structure shown in the figure). Furthermore, Lipman discloses that these smaller tables are "trie tables" as claimed. "Trie tables" are defined in the claim as being "addressed by a span of Internet protocol (IP) address bits to locate an indexed trie entry, the indexed trie entry including a route pointer and a trie pointer. This is taught by Lipman in columns 10-11, wherein each small table is addressed by a span of IP address bits ("IP address bits [15:8]") to locate an indexed trie entry (col. 10, lines 39-46, 61-63), the indexed trie entry including a route pointer ("next hop address") and a trie pointer ("key"; col. 10, lines 39-46; col. 11, lines 5-14, wherein the next hop address points to a destination address and the key points to another trie table within the routing structure). Thus, Lipman discloses that the root table branches to nodes containing small trie tables, as claimed.

In considering (c), Applicant contends that Lipman does not disclose "traversing in parallel the two trie tables to find a match of a trie entry to the prefix," as claimed in claim 28. Examiner respectfully disagrees. Lipman discloses this features in column 14, lines 29-32, "there can be multiple lookups pending at a given time in the address resolution logic," and column 16, lines 26-28, "comparison logic 192, and search control logic 194 of Fig. 9 are configured to compare the search key to four tree entries simultaneously").

Therefore, the claims remain rejected in view of Lipman.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bradley Edelman whose telephone number is (703) 306-3041. The examiner can normally be reached on Monday to Friday from 8:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glen Burgess can be reached on (703) 305-4792. The fax phone numbers for the organization where this application or proceeding is assigned are as follows:

For all correspondences: (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.


FRANTZ B. JEAN
PRIMARY EXAMINER

BE
October 8, 2004